Touchless Despinning of Asteroids and Comets via Neutral Beam Emitting Spacecraft

Completed Technology Project (2015 - 2018)

Project Introduction

This project seeks to design, build, and test a device that is capable of despinning an asteroid without the need for affixing the spacecraft to the surface. This research will use my refined models on asteroid strength to design a neutrally charged beam that can apply a torque onto the asteroid while keeping in a hovered position over the surface through an electric propulsion (EP) system. The first major portion of my research will design and test a component that extracts energy during the creation of the neutral beam to partially supply the EP's energy needs. This component development will incorporate advanced materials, thermoelectric generators, and a possible cooling system. The testing of the power extraction module will occur in a vaccum environment downstream of an ion source such as an EP where I will measure the power output and efficiency of this module. The next brief portion will determine if neutrally charged beams are safer than EP for interacting with the asteroid surface as a proof of concept and clear argument for neutral beams. This will be conducted in a vaccum environment that uses regolith simulant piles to mimic the surface of an asteroid. Finally, a system will be designed, built, and tested that combines a neutrally charged beam, EP, and control system to build the first asteroid despinning device. The design and testing portions will incorporate thermal and plasma analysis to determine the efficiency of the system and its potential for providing the requisite torque needed to despin an asteroid. The NSTRF seeks to develop low-TRL technologies to advance space technology capabilities. My project will create the first power extraction module to neutralize ion flow in a neutral beam emitter. My proposal also is the first to propose using a neutral beam to despin an asteroid and the coupling of this system to an EP. From this, I will build a single module that can be attached as a payload onto a satellite designed to intercept an asteroid or comet. The Human Exploration Destination Systems Roadmap, TABS 7.5.4 looks for technologies that will be able to protect Earth from Near Earth Objects. My technology proposal addresses this need and will be the first step in controlling our solar system's most common bodies.

Anticipated Benefits

This project seeks to design, build, and test a device that is capable of despinning an asteroid without the need for affixing the spacecraft to the surface.

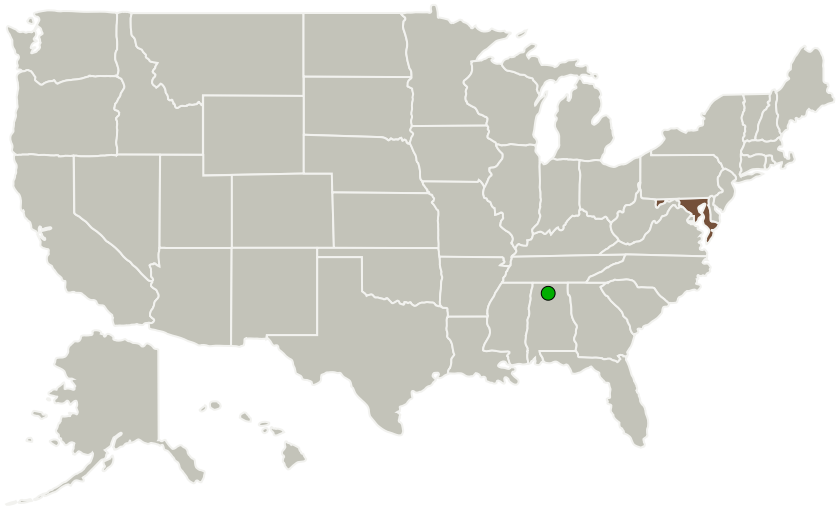
Touchless Despinning of Asteroids and Comets via Neutral Beam Emitting Spacecraft

Table of Contents

Touchless Despinning of Asteroids and Comets via Neutral Beam Emitting Spacecraft

Completed Technology Project (2015 - 2018)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Maryland-College Park(UMCP)	Lead Organization	Academia Asian American Native American Pacific Islander (AANAPISI)	College Park, Maryland
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations
Maryland

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Maryland-College Park (UMCP)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Christine Hartzell

Co-Investigator:

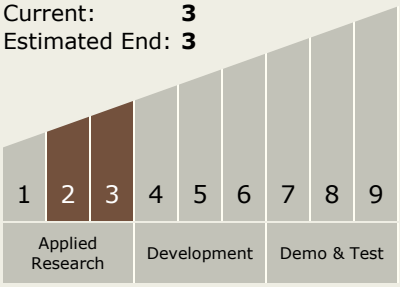
Anthony J Decicco

Touchless Despinning of Asteroids and Comets via Neutral Beam Emitting Spacecraft

Completed Technology Project (2015 - 2018)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.2 Resource Acquisition, Isolation, and Preparation

Target Destination

Others Inside the Solar System